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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/065,956	12/04/2002	Bernhard Liegl	2001P19570US	2530
25962	7590	10/01/2004	EXAMINER	
SLATER & MATSIL, L.L.P. 17950 PRESTON RD, SUITE 1000 DALLAS, TX 75252-5793			SAGAR, KRIPA	
			ART UNIT	PAPER NUMBER
			1756	
DATE MAILED: 10/01/2004				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/065,956	Applicant(s) LIEGL ET AL.	
	Examiner Kripa Sagar	Art Unit 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 July 2004.
 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-8, 12, 15 and 20-25 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☐ Claim(s) _____ is/are allowed.
 6) ☒ Claim(s) 2-8, 12, 15 and 20-25 is/are rejected.
 7) ☐ Claim(s) _____ is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☒ The drawing(s) filed on 04 December 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. Applicants' amendment filed 7/9/04 has been entered. Claims 2,6,8,12,15,20,21 have been amended. Claims 22-25 have been added. No new matter has been introduced. Claims 1,9-11,13,14,16-19 have been cancelled.

Claims 2-8,12,15,20-25 are under consideration.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 15 improperly depends from cancelled claim 9; hence it has not been further examined on its merits.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 20,21 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Japanese patent JP 64-015926 to Ofuji.

The claims recite a method of pattern transfer comprising lithographic steps wherein evaporating the solvent from the coated photosensitive layer /photoresist without using elevated temperatures results in reduced sidewall roughness after exposure and development.

Ofuji teaches applying a resist on a substrate ("layer"); exposing the resist to a vacuum atmosphere at room temperature to evaporate the solvent. The resist is exposed to UV rays and the exposed areas are developed. Ofuji states that the low temperature curing prevents thermal decomposition of the photosensitive groups in the resist (Abstract).

The amended claims recite above room temperature (RT) and below 70deg.C to distinguish the claims from cited art. However the kinetics of evaporation of solvents from films is known to depend on temperature and pressure; the increase in temperature above RT merely accelerates Ofuji's process and would have been an obvious modification of the art-cited process. Ofuji does not explicitly teach the reduction in sidewall roughness of patterns. However this is an inherent feature of the process as admitted by Applicant. Applicant states in the specification that the low temperature and/or vacuum curing prevent "phase separation" in the photosensitive layer. Improved line edges (sidewalls) are attributed to this (instant specification: p.2;#0006). Ofuji teaches the same principles. The improvement is an inherent

consequence of Ofuji's process. Applicants have merely discovered a natural consequence of the process.

6. Claims 2,4-6,12,20-25 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US Pat.6261007 to Takamori et al.

Claims 20,21 recite a pattern transfer method in fabricating an IC wherein the substrate coated with a photosensitive layer is dried using temperatures above RT and below 70 deg.C. The method results in a pattern with reduced sidewall roughness. Dependent claims 2-8,12,15, 22-25 recite, among others limitations, using a photoresist , an ARC (anti-reflective coating), spin coating, vacuum, above room temperature curing.

Takamori teaches that the steps of the instant invention recited in 20,21 are conventional in photolithography (col.1;line.19-48) which includes conventional drying or pre-bake at high temperatures. The process includes spin coating of photoresist. Takamori improves on the process using low pressure drying at room temperature (2;49-46). Takamori teaches that this results in more uniform removal of solvents and hence reduced fluctuations in linewidths (2;24-29). Takamori does not explicitly teach reduction in LER; however this is an inherent consequence of the process. LER is known to contribute to fluctuations in linewidths (see: response to arguments below) and thus Takamori implicitly teaches the reduction in LER due to vacuum drying. The drying is accomplished at room temperature. The pressure is reduced to 0.1 Torr (13.3Pa) which is within the range of the instant invention recited (2;58-64).

Takamori does not teach use of elevated temperature drying. However the kinetics of solvent evaporation from films are well known in the art (Takamori: 9;43-46). One of ordinary skill would readily know that solvents would evaporate more rapidly under elevated temperature or reduced pressure; the vapor pressure and boiling point of the solvent dictating the combination of temperature and pressure. The instant temperatures and pressures can be readily arrived at by one of ordinary skill in the art. The modification of "low temperature" to "above room temperature and below 70 deg.C" is an obvious extension of the drying process of Takamori that accelerates the drying process, reduces cycle time and thereby increases productivity.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 3,7,8 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 6443641 to Takamori et al. in view of US PGPUB 2002/0182514 to Montgomery et al.

The teachings of Takamori are recited above.

Takamori does not teach use of ARCs [cl.3,7,8].

Montgomery teaches the use of ARCs under photoresist coatings (fig.1A & p.3;#0019). The ARCs, well known in prior art, are routinely used to reduce standing waves in the resist, which are known to result in line edge roughness (p.3;#0020). It

would have been obvious to one of ordinary skill in the art at the time the invention was made to use ARCs under photoresists as known in prior art taught by Montgomery, because they are known to reduce standing waves and to minimize line edge roughness.

Response to Arguments

9. Applicant's arguments filed 7/9/04 have been fully considered .

Applicants' arguments with reference to the rejection based on 35USC112 first paragraph, presented in the earlier office action are not convincing. However in a telephone discussion on 9/24/04 attorney Kesterson stated that the Applicants are not obliged to provide evidence in support of their claims, absent any evidence to the contrary. In light of this the rejection is withdrawn.

The current amendments do not place the independent or dependent claims in a condition for allowance and the prior rejections are restated. The modification of "low temperature" to "above room temperature and below 70 deg.C" is an obvious extension of the drying process of Takamori and Ofuji that accelerates the drying process, reduces cycle time and thereby increases productivity.

LER is a significant contributor to critical dimension or line width variation in lithography. This would be intuitive to one of ordinary skill in the art; however this is also shown by Koh: 2;14-17 & fig.3 (cited earlier). It is the Examiner's position that the reduction in line width variation due to vacuum drying in Takamori's process is due to the inherent reduction in LER. Applicants have merely re-discovered the effects of

Takamori's process which is similar to the instant claimed process. The same effect is implicit in Ofuji's vacuum process.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

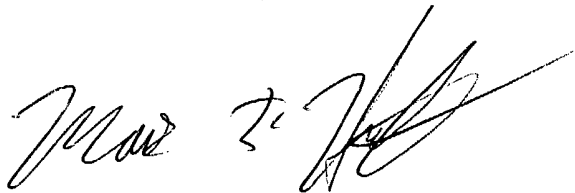
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 571-272-1392. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1756

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MH/ks

A handwritten signature in black ink, appearing to read 'Mark F. Huff', with a stylized flourish extending from the end.

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700